REMARKS

Applicant responds to the Office Action using the corresponding paragraph numbers.

The claims discussed are those presented in the Supplemental Amendment filed October 30, 2003, some of which are proposed to be amended.

15. Applicants acknowledge that claims 24-30 are allowed.

16. The allowability of the subject matter of claims 3, 4, 6, 9-13, 31 and 32 is noted. These claims are amended so as to be allowable by rewriting in proper independent form. In claims 11-13, the surface normal optical device has been deleted since these claims relate to the step of filling the trench with a material. In some of these claims the term "goes straight through" has been amended to "passes through", as explained in Paragraph 2.&3. below.

2.&3. Claims 14-23 and 33 are rejected as being indefinite. In main claim 14, from which claims 15-23 and 33 depend, the Examiner objects to the use of the term "straight" in referring to the path of the light transmitted from the divided portion each of the optical waveguides. Claim 14 has been amended by replacing the term "goes straight through" to "passes through". Also, in claim 14, the term "linear", relating to the trench, has been deleted since it is not believed to be necessary for purposes of patentability. The Examiner rejects claim 19 on the ground that many of the recited elements would not permit light to pass "straight through". The deletion of the term "straight" from parent claim 14 overcomes this rejection. Minor editorial amendments have been made to some of these claims.

No prior art has been applied against claims 14-23 and 33. Therefore, these claims should be allowable.

1. Claim 2 is objected to because of use of the phrase "the electrode on the surface of the substrate". Applicants have amended claim 2 so that the transparent electrodes are part of a flexible substrate that lies on a flexible rubber member of the device substrate. Reference is made to Example 1 and Fig. 1D. Therefore, this objection should be overcome.

4.&5. Claims 1, 2, 5 and 7 are rejected as being anticipated by Gipson, U.S. 4,732,466.

As set forth in independent apparatus claim 1 and method claim 7, the present invention provides a waveguide-type optical device comprising a substrate in which there are optical waveguides or optical fibers. A trench is formed across the substrate so as to divide the waveguides or the optical fibers into two portions. A pair of electrodes are provided on the substrate one of the pair for each waveguide or optical fiber portion. A material or device, which has an electro-optic effect, a thermo-optic effect, or a light emitting function, is filled or inserted in the trench.

As to the material or device in the trench, Example 1 in the Specification relates to a polarizing light controller in which a polarizing light controlling device is inserted in the trench. Example 2 is a polarizing light controlling device formed by filling nematic liquid crystal in the trench. Example 3 is an optical shutter array, in which PLZT electro-optic crystal is inserted in the trench. Other examples disclosed are an optical device by inserting thin polyimide resin plates, and a light power monitor by inserting a compound semiconductor crystal, and device for obtaining a linear polarized wave by inserting a polarizing element in the trench.

Each of claims 1 and 7 has been amended to recite that there is a pair of electrodes for each of the optical waveguides or optical fibers.

Further, it is recited that each of the electrodes extends from the substrate <u>onto</u> the corresponding wall surface of the trench. Claim 1 calls for the electrodes to be transparent. Therefore, there is optical coupling of light from an optical waveguide or fiber into the material or device in the trench. Claim 7 generally recites an electrode that is on each wall of the trench. As seen from page 22, lines 5-12 of the Specification, the electrode can be either transparent (as in claim 1) or conductive so as to be able to supply a voltage to the material or device in the trench.

Gipson discloses a printed circuit board 10 having an optical data bus of optical fibers 16 embedded therein. Through holes 14 are formed in the printed circuit board at predetermined locations to receive a novel chip carrier 12. The chip carrier has a transparent area that interfaces with the optical fibers. Optical data entering the chip carrier from the fibers is intercepted by an optical beam splitter 32, which directs the signals to a phototransistor die for conversion to electrical signals which are then conducted to an integrated circuit die and into the printed circuitry in the

printed circuit board. In Fig. 1, a lens 36 is provided to focus the light from a fiber onto the beam splitter. In Fig. 5, there is only the clear window 30.

The present invention differs from the printed circuit board disclosed by Gipson in which optical fibers are embedded, and through holes are formed at predetermined locations each to receive a novel chip carrier. In contrast to Gipson, the waveguide-type optical element of the present invention has a substrate, made of Si, for example, and a trench formed in the substrate which divides the waveguides or optical fibers. Optical material or an optical device is filled or inserted in the trench. The term trench as in any Dictionary means that there is a bottom, meaning that the trench leaves the bottom surface as a part of the substrate. Gipson discloses through holes and not the trench which would have a bottom. Therefore, the optical waveguide or optical fibers of the invention are not squeezed when they interface with the material or device in contrast to Gipson, in which optical fibers are squeezed at the holes 14 to face the chip carrier.

The present invention as set forth in each of the independent claims 1 and 7 also claims a pair of electrodes for each waveguide formed with one electrode of the pair on each side of the trench extending <u>onto the wall</u> of the trench. The electrodes are useful because they face the material or device in the trench and the electrodes on the walls make it is possible to drive a material or a device inserted in the trench by applying either light or a voltage to these electrodes, depending upon their type.

Gipson does not disclose a device in which it is possible to directly drive the device embedded in a trench, as is accomplished by the electrodes of claims 1 and 7, which are on the walls of the trench. It is necessary for Gipson to set the chip case to the hole position and to align the chip case to connect to the optical fibers around the hole. Accordingly, the concept of the present invention markedly differs from that of Gipson.

7. In the rejection of claim 2, the Examiner considers this as obvious from Fig. 10 of Gipson. But this Figure does not teach or suggest electrodes which are part of a flexible substrate.

8. As to claim 5, Gipson does show the insertion of surface type detectors, light modulators, and lasers in parallel to the propagation direction of the light. In contrast, in the present invention, the surface-type modulators, surface-type light emitting lasers and detectors of the

surface normal optical device are inserted in the trench perpendicularly crossing the propagation direction of the light.

Accordingly, claims 1, 2 and 5 set forth novel and advantageous devices and claim 7 sets forth a novel method for making a device that is not taught or suggested by the prior art. Therefore, these claims are patentable and should be allowed.

9.-14. Claim 8 is rejected over the combination of Gipson in view of Wojnarowski, U.S. 5,562,832. Claim 8 depends from method claim 7 and calls for the electrodes to be formed by sputtering or vapor deposition.

Wojnarowski is relied on to supplement Gipson, which does not show electrodes being placed in a trench by sputtering or vapor deposition. Although Wojnarowski teaches forming a metal layer as an electrode on the entire inner surface area of the trench formed in a resin substrate, Wajnarowski does not disclose the feature of the present invention to form an electrode on both the side walls of a trench formed in the substrate by sputtering or vapor deposition. That is, combination of Wajnarowski with Gipson does not teach or suggest the novel method as set forth in claim 8. Therefore, this claim is also patentable and should be allowed.

The amendment should be entered since it clearly places the application in condition for allowance. It does not raise any new issues that would require a further search.

If the Examiner disagrees with this and refuses to enter the present amendment because of a "new issue" he is respectfully requested to at least determine if the claims not rejected on prior art, that is, claims 24-30 (Paragraph 15.), 3, 4, 6, 9-13, 31 and 32 (Paragraph 16.), and 14-23 (Paragraphs 2 and 3), are now allowable and so indicate.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Prompt and favorable action is requested.

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Respectfully submitted,

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